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SERIES Q: SWITCHING AND SIGNALLING, AND ASSOCIATED MEASUREMENTS AND TESTS

Testing specifications – Testing specifications for IMT-2020 and IoT

Signalling requirements for the virtualized network function lifecycle management in a testing environment

Recommendation ITU-T Q.4067

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SWITCHING AND SIGNALLING, AND ASSOCIATED MEASUREMENTS AND TESTS

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Recommendation ITU-T Q.4067

Signalling requirements for the virtualized network function lifecycle management in a testing environment

Summary

Recommendation ITU-T Q.4067 specifies the process and signalling requirements for virtualized network function (VNF) lifecycle management in a testing environment by architecturally adding the testing platform in the network functions virtualization (NFV) framework. The signalling focuses on the interface between the VNF instantiation functional component in a testing platform and the network functions virtualization orchestrator (NFVO) functional component in management and orchestration (MANO).

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

Signalling requirements, testing, VNF lifecycle management.

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Signalling requirements for the virtualized network function lifecycle management in a testing environment

1 Scope

The scope of this Recommendation consists of:

– Overview of virtualized network function (VNF) lifecycle management in a testing environment;

– Signalling requirements of VNF lifecycle management in a testing environment.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.3321]   Recommendation ITU-T Y.3321 (2015), *Requirements and capability framework for NICE implementation making use of software-defined networking technologies.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 virtualized network function [ITU-T Y.3321]: A network function whose functional software is decoupled from hardware, and runs on virtual machine(s).

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

GUI   Graphical User Interface

ID   Identity

MANO   Management and Orchestration

NFV   Network Functions Virtualization

NFVI   Network Function Virtualization Infrastructure

NFVO   Network Functions Virtualization Orchestrator

SCTP   Stream Control Transmission Protocol

TCP   Transmission Control Protocol

TLS	Transport Layer Security
UDP	User Datagram Protocol
vBRAS	virtual Broadband Remote Access Server
vEPC	virtual Evolved Packet Core
vFW	virtual Firewall
VIM	Virtualized Infrastructure Manager
VNF	Virtualized Network Function
VNFD	Virtualized Network Function Descriptor
VNFM	Virtualized Network Function Manager
XML	Extensible Markup Language

5 Conventions

In this Recommendation:

In the body of this Recommendation and its appendixes, the words shall, shall not, should, and may sometimes appear, in which case they are to be interpreted, respectively, as is required to, is prohibited from, is recommended, and can optionally. The appearance of such phrases or keywords in an appendix or in material explicitly marked as informative are to be interpreted as having no normative intent.

{A}: indicates that the parameter A is mandatory;

[A]: indicates that the parameter A is optional;

*: indicates that the parameter may be multiple items.

6 Overview of VNF lifecycle management in a testing environment

6.1 Problem statement

According to the definition in [b-ETSI GS NFV-IFA 011], each virtualized network function (VNF) has a specific virtualized network function manager (VNFM) to be responsible for its lifecycle management in a production environment. Even if the VNFs from different vendors have the same functionality, their respective VNFMs are not the same. From the perspective of operators, it is too redundant and inefficient to use different interfaces and signalling to test different VNFs. As an orchestrator, the network functions virtualization orchestrator (NFVO) can interact with different VNFMs to achieve the orchestration of network services. Therefore, operators can build a testing platform to connect with NFVO and realize the lifecycle management of different VNFs through a uniform interface. This mechanism can shield the difference of different VNFMs and achieve the unified testing management.

The testing platform contains multiple functional components, such as a graphical user interface (GUI) functional component, a VNF instantiation functional component, a test case management functional component, etc. This Recommendation defines the signalling between the VNF instantiation functional component in a testing platform and a NFVO functional component in management and orchestration (MANO).

6.2 Signalling architecture

The VNF lifecycle management signalling architecture in a testing environment is shown in Figure 6-1. A testing platform is used to test the function and performance of VNF via a VNF

instantiation functional component, such as a virtual evolved packet core (vEPC), a virtual firewall (vFW), a virtual broadband remote access server (vBRAS), etc.

The functions and reference points of NFVO, VNFM, virtualized infrastructure manager (VIM), and network functions virtualization infrastructure (NFVI) are defined in [b-ETSI GS NFV 002]. Besides those, the VNF instantiation functional component exchanges the necessary information with NFVO functional component to accomplish the operation of VNF instance in its lifecycle time in the testing environment automatically.
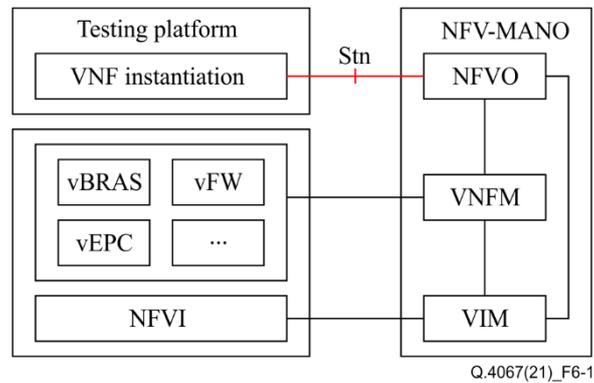

Figure 6-1 – The VNF lifecycle management signalling architecture in a testing environment

6.3 Interface requirements of Stn

The Stn interface presented in Figure 6-1 is used to exchange information to perform VNF lifecycle management functionality in a testing environment.

The Stn interface permits the interaction between a VNF instantiation functional component and a NFVO functional component. The NFVO functional component receives the VNF lifecycle management request from the VNF instantiation functional component. If it fails, the VNF instantiation functional component sends the failure message to the NFVO functional component.

7 Signalling requirements of the VNF lifecycle management in a testing environment

7.1 Message type

For the VNF lifecycle management in a testing environment, the message types presented in Figure 7-1 should be followed.
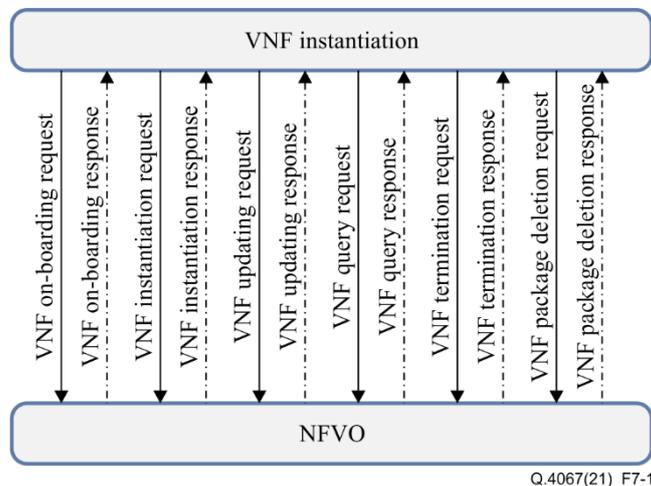

Figure 7-1 – Messages of the VNF lifecycle management in the testing environment

As depicted in Figure 7-1, all the message interactions between the VNF instantiation functional component and NFVO functional component are in request and response mode. The request messages include VNF on-boarding, VNF instantiation, VNF updating, VNF query, VNF termination and VNF package deletion. The response message from the NFVO functional component contains the handing results of the corresponding requests and parameters.

Detailed descriptions of the message pairs are as follows:

1) VNF on-boarding: used for uploading the VNF package, including VNF image file, VNFD, VNF information file including VNF type and resource information, VNF service configuration script file and VNF manifest file, as defined in [b-ETSI GS NFV-IFA 011].

2) VNF instantiation: used for instantiating the VNF, which is not in use.

3) VNF updating: used for updating the status, information and scaling of the current VNF instance.

4) VNF query: used for querying the status of the current VNF instance.

5) VNF termination: used for terminating the current VNF instance.

6) VNF package deletion: used for deleting the VNF package when it is disabled and not in use.

NOTE – No transport protocol for the signalling messages is specified here. No message content format is specified here either.

The signalling messages may be XML-based messages over (or carried by) transmission control protocol (TCP), user datagram protocol (UDP), stream control transmission protocol (SCTP), transport layer security (TLS), etc. All of the messages are in the message header and message body format.

The message format is described in Figure 7-2.
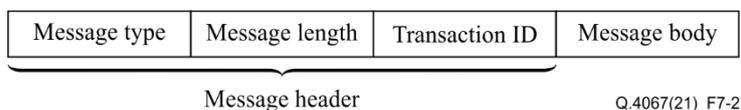
Figure 7-2 – Message composition

The message header field should contain the following information:

1) Message type: uniquely specifies the type of the message;

2) Message length: specifies the length of the message body, which comes right after the message header;

3) Transaction ID: generated by the sender of the message. If there is a response message for the request message, the transaction IDs of the request and response messages are the same.

The message body field contains the content of the message.

7.2 Message format

7.2.1 VNF on-boarding message and response message

The VNF on-boarding request (OB-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to upload the VNF package.

Message format:

```
< OB-REQ-Message > ::= < Message header >
          *{ Flow-Attribute }
          { VNF-Package-ID }
```

Meanings and explanations:

1)   `Flow-Attribute` distinguishes the network flows to be handled. This contains several fields of network flows. The type of network flow is indicated in the packet header. There may be multiple network flow attribute items.

2)   `VNF-Package-ID` uniquely specifies the installation file ID of VNF instance.

The response message to the OB-REQ message is defined as the VNF on-boarding response (OB-RSP) message.

The OB-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the OB-REQ message.

Message format:

```
< OB-RSP-Message > ::= < Message Header >
            { On-boarding-Result }
            [ VNF-Package-ID ]
```

Meanings and explanations:

1)   `On-boarding-Result` specifies VNF on-boarding result. If the VNF on-boarding is allowed, `On-boarding-Result` is TRUE; if not, `On-boarding-Result` is FALSE.

2)   `VNF-Package-ID` uniquely specifies the installation file ID of VNF instance.

7.2.2 VNF instantiation message and response message

The VNF instantiation request (INS-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to instantiate the VNF.

Message format:

```
< INS-REQ-Message > ::= < Message header >
            *{ Flow-Attribute }
            { VNF-Package-ID }
            { VNFD-ID }
```

Meanings and explanations:

1)   `Flow-Attribute` distinguishes the network flows to be handled. This contains several fields of network flows. The type of network flow is indicated in the packet header. There may be multiple network flow attribute items.

2)   `VNF-Package-ID` uniquely identifies the VNF package to be used to instantiate the VNF;

3)   `VNFD-ID` uniquely identifies the VNFD to be used to instantiate the VNF.

The response message to the INS-REQ message is defined as the VNF instantiation response (INS-RSP) message.

The INS-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the INS-REQ message. This message shows the handling results of the INS-REQ message.

Message format:

```
< INS-RSP-Message > ::= < Message Header >
            { Instantiation-Result }
            [ VNF-ID ]
```

Meanings and explanations:

1) `Instantiation-Result` specifies VNF instantiation result. If the VNF instantiation is successful, `Instantiation-Result` is TRUE; if not, `Instantiation-Result` is FALSE.

2) `VNF-ID` uniquely identifies the created VNF instance.

7.2.3 VNF updating message and response message

The VNF updating request (UPD-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to update the VNF instance.

Message format:

```
< UPD-REQ-Message > ::= < Message header >
            { VNF-ID }
            *{ Flow-Attribute }
            { VNF-Package-ID }
            { VNFD-ID }
```

Meanings and explanations:

1) `VNF-ID` uniquely identifies the VNF instance which needs updating.

2) `Flow-Attribute` distinguishes the network flows to be handled. This contains several fields of network flows. The type of network flow is indicated in the packet header. There may be multiple network flow attribute items.

3) `VNF-Package-ID` uniquely identifies the VNF package to be used to update the VNF instance;

4) `VNFD-ID` uniquely identifies the VNFD to be used to update the VNF instance.

The response message to the UPD-REQ message is defined as the VNF updating response (UPD-RSP) message.

The UPD-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the UPD-REQ message. This message shows the handling results of the UPD-REQ.

Message format:

```
< UPD-RSP-Message > ::= < Message Header >
            { Updating-Result }
            [ VNF-ID ]
```

Meanings and explanations:

1) `Updating-Result` specifies VNF updating result. If the VNF instance is updated successfully, `Updating-Result` is TRUE; if not, `Updating-Result` is FALSE.

2) `VNF-ID` uniquely identifies the updated VNF instance.

7.2.4 VNF query message and response message

The VNF query request (QUE-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to query the VNF instance.

Message format:

```
< QUE-REQ-Message > ::= < Message header >
            { VNF-ID }
```

Meanings and explanations:

1) `VNF-ID` uniquely identifies the VNF instance to be queried.

The response message to the QUE-REQ message is defined as the VNF query response (QUE-RSP) message.

The QUE-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the QUE-REQ message. This message shows the handling results of the QUE-REQ message.

Message format:

```
< QUE-RSP-Message > ::= < Message Header >
              { Query-Result }
              [ VNF-ID ]
              [ VNF-Package-ID ]
              [ VNFD-ID ]
```

Meanings and explanations:

1)   Query-Result specifies VNF query result. If the VNF instance is queried successfully, Query-Result is TRUE; if not, Query-Result is FALSE.

2)   VNF-ID uniquely identifies the queried VNF instance.

3)   VNF-Package-ID uniquely identifies the queried VNF package of the VNF instance.

4)   VNFD-ID uniquely identifies the queried VNFD of the VNF instance.

7.2.5   VNF termination message and response message

The VNF deletion request (TER-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to terminate the VNF instance.

Message format:

```
< TER-REQ-Message > ::= < Message header >
              { VNF-ID }
```

Meanings and explanations:

1)   VNF-ID uniquely identifies the VNF instance to be terminated.

The response message to the TER-REQ message is defined as the VNF termination response (TER-RSP) message.

The TER-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the TER-REQ message. This message shows the handling results of the TER-REQ message.

Message format:

```
< TER-RSP-Message > ::= < Message Header >
              { Termination-Result }
              [ VNF-ID ]
```

Meanings and explanations:

1)   Termination-Result specifies VNF termination result. If the VNF instance is terminated successfully, Termination-Result is TRUE; if not, Termination-Result is FALSE.

2)   VNF-ID uniquely identifies the terminated VNF instance.

7.2.6 VNF package deletion message and response message

The VNF package deletion request (PAD-REQ) message, indicated by the message type in the message header field, is sent by the VNF instantiation functional component to delete the VNF package.

Message format:

```
< PAD-REQ-Message > ::= < Message header >
                { VNF-Package-ID }
```

Meanings and explanations:

1)   `VNF-Package-ID` uniquely identifies the VNF package to be deleted.

The response message to the PAD-REQ message is defined as the VNF package deletion response (PAD-RSP) message.

The PAD-RSP message, indicated by the message type in the message header field, is sent by the NFVO functional component to the VNF instantiation functional component in response to the PAD-REQ message. This message shows the handling results of the PAD-REQ message.

Message format:

```
< PAD-RSP-Message > ::= < Message Header >
                { VNF-Package-Deletion-Result }
                [ VNF-Package-ID ]
```

Meanings and explanations:

1)   `VNF-Package-Deletion-Result` specifies VNF package deletion result. If the VNF package is deleted successfully, `VNF-Package-Deletion-Result` is TRUE; if not, `VNF-Package-Deletion-Result` is FALSE.

2)   `VNF-Package-ID` uniquely identifies the deleted VNF package.

Bibliography

[b-ETSI GS NFV-IFA 011]   ETSI GS NFV-IFA 011 V4.1.1 (2020), *Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; VNF Descriptor and VNF Packaging Specification.*

[b-ETSI GS NFV 002]   ETSI GS NFV 002 V1.2.1(2014), *Network Functions Virtualisation (NFV); Architectural Framework.*

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